No. 7

Given

R = 0.2871

Cp = 1.005 $^{kJ}/_{kg}$ K

Cv = 0.718 $^{kJ}/_{kg}$ K

P1 = 80 bar

V1 = 0.02 m^3

From 1 to 2 Adiabatic

P2 = 140 bar

From 2 to 3 P = Const.

P3 = 140 bar

From 3 to 1 $PV^{1.12}$ = const.

Answer

$80x0.02^{1.12} = 140xV3^{1.12}$

V3 = 0.01213477527 m^3

R = $^{P1v1}/_{T1}$

T1 = 557.297109 K

U1 = mCvT = 400.1350026 $^{kJ}/_{kg}$

H1 = mCpT = 560.07645 $^{kJ}/_{kg}$

$P1V1^y = P2V2^y$

V2 = 0.0134100864 m^3

T2 = $^{P2V2}/_{R}$ = 653.9224276 K

U2 = 469.516303 $^{kJ}/_{kg}$

H2 = 657.1920397 $^{kJ}/_{kg}$

T3 = $^{P3V3}/_{R}$ = 591.7340781 K

U3 = 424.8650681 $^{kJ}/_{kg}$

H3 = 594.6927485 $^{kJ}/_{kg}$

Q1-2 = 0 (Adiabatic)

W1-2 = U1 - U3 = -69.3813004 $^{kJ}/_{kg}$

W1-2 = $^{P1V1 - P2V2}/_{y-1}$ = -69.353024 $^{kJ}/_{kg}$

Q2-3 = H3 - H2 = -62.4992912 $^{kJ}/_{kg}$

W2-3 = P(V2-V1) = -17.85435582 $^{kJ}/_{kg}$

Q2-3 = U3 - U2 = -62.5058972 $^{kJ}/_{kg}$

W3-1 = $^{P3V3 - P1V1}/_{0.12}$ = 82.39044817 $^{kJ}/_{kg}$

Q3-2 = U1 - U3 + W = 57.66938267 $^{kJ}/_{kg}$

Qsum = -4.84520805 $^{kJ}/_{kg}$

Wsum = -4.81414765 $^{kJ}/_{kg}$

$S2 - S1 = mCvLn(^{T2}/_{T1}) + mRLn(^{V2}/_{V1})$

S2 - S1 = 0

S3 - S2 = -0.04306234236 $^{kJ}/_{kg}$ K

S1 - S3 = 0.1004010682 $^{kJ}/_{kg}$ K